

CLAIMS

What is claimed is:

1. A bioartificial liver system for treating hepatic functional impairment, said system comprising:
 - a means for separating a blood stream from a patient into plasma and blood cells;
 - 4 a means for detoxifying the plasma, said means comprising:
 - 6 a sealable chamber having a plasma inlet and a gas inlet;
 - 8 a plurality of animal liver slices; and
 - 10 a mesh at least partially surrounding said animal liver slices so as to form a space and to retain said slices within said space, said mesh being positioned approximately horizontal at or near an upper portion of the chamber;
 - 12 a means for selectively supplying and removing plasma from the chamber, said means being configured so that when the plasma is supplied to the chamber the plasma comes into contact with the liver slices, and when the plasma is removed from the chamber the plasma is not in contact with the liver slices;
 - 14 a means for supplying a gas to the top of the chamber;
 - 16 a reservoir for containing plasma as it enters and exits the chamber; and
 - 18 a means for reintroducing the plasma and blood cells back to the patient, wherein said animal liver slices are cultured in an environment of an oxygenated gas and under the supply of a liquid culture medium so that said slices are exposed alternatively at

regular intervals to said medium and to said gas thereby detoxifying the plasma and treating
20 hepatic functional impairment.

2. The system of claim 1, the culture apparatus further comprising a second reservoir
2 for receiving detoxified plasma from the chamber.

3. The system of claim 1, wherein the gas is a mixture of oxygen and carbon
2 dioxide.

4. The system of claim 3, wherein the gas-to-plasma exposure time ratio to the
2 animal liver slices is about 1:2 to about 1:4.

5. The system of claim 3, wherein the gas-to-plasma exposure time ratio to the
2 animal liver slices is about 1:3.

6. The system of claim 2, further comprising an immunological filter inserted
2 downstream from the second reservoir.

7. The system of claim 1, wherein the chamber is thermoregulated.

8. A bioartificial liver system for treating a patient with hepatic functional
2 impairment, said system comprising:

- a means for separating a blood stream taken from the patient into a plasma stream and a
4 blood cell stream; and
a liver-slice culture apparatus used as a bioreactor to detoxify the plasma stream, the
6 culture apparatus comprising:
a sealable chamber having a plasma inlet and a gas inlet;
8 at least two meshes mounted approximately parallel, one above the other, near the
upper portion of the chamber so as to form at least two approximately horizontal layers
10 separated by a space;
a plurality of animal liver slices positioned within said space;
12 means for selectively supplying and removing plasma in the chamber so that the
plasma in the chamber comes into contact with the liver slices, and is removed from
14 contact with the liver slices;
means for supplying a gas to the top of the chamber; and
16 a reservoir for containing plasma as it enters and exits the chamber, said animal
liver slices being cultured in an environment of an oxygenated gas under the supply of a
18 liquid culture medium at regular intervals so that said slices are exposed alternatively to
the medium and to the gas.
9. The system of claim 8, the culture apparatus further comprising a second reservoir
2 for receiving detoxified plasma from the chamber.
10. The system of claim 8, wherein the gas is a mixture of oxygen and carbon
2 dioxide.

11. The system of claim 10, wherein the gas-to-plasma exposure time ratio to the
2 animal liver slices is about 1:2 to about 1:4.

12. The system of claim 10, wherein the gas-to-plasma exposure time ratio to the
2 animal liver slices is about 1:3.

13. The system of claim 9, further comprising an immunological filter inserted
2 downstream from the second reservoir.

14. The system of claim 8, wherein the chamber is thermoregulated.

15. A method to detoxify the plasma from a mammal, the method comprising:
2 separating plasma from whole blood of the mammal;
3 contacting the plasma with animal liver slices, the animal liver slices being contained in a
4 bioreactor, the bioreactor being made up of a sealable chamber having a plasma inlet and a gas
5 inlet, at least two meshes mounted approximately parallel, one above the other near the upper
6 portion of the chamber so as to form at least two approximately horizontal layers separated by a
7 space, a plurality of animal liver slices positioned within said space, means for selectively
8 supplying and removing plasma in the chamber so that the plasma in the chamber comes into
contact with the liver slices, and is removed from contact with the liver slices, means for

10 supplying a gas to the top of the chamber, a reservoir for containing plasma as it enters and exits
the chamber the space between two meshes, the method further comprising the steps of:
12 contacting the liver slices with a gas mixture of oxygen and carbon dioxide;
 exposing the liver slices alternatively to plasma and the gas mixture of oxygen and
14 carbon dioxide gas; and
 returning detoxified plasma to the mammal.

16. The method of claim 15, wherein the gas-to-plasma exposure time ratio to the
2 animal liver slices is about 1:3

17. A method of treating a hepatic failure patient, the method comprising:
2 separating the plasma from the whole blood of the mammal;
 contacting the plasma with animal liver slices contained in a space between two meshes;
4 contacting the liver slices with a gas mixture of oxygen and carbon dioxide;
 exposing the liver slices alternatively to the plasma and the gas mixture of oxygen and
6 carbon dioxide gas; and
 returning to detoxified plasma to the mammal and the mammal's blood is thereby
8 detoxified.

18. The method of claim 17, wherein the gas-to-plasma exposure time ratio to the
2 animal liver slices is about 1:3.